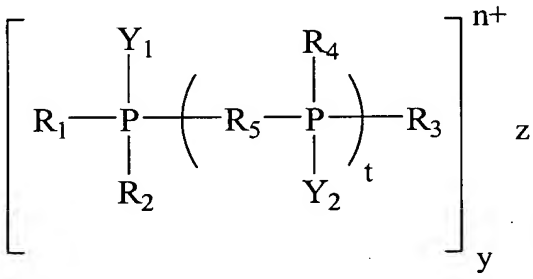
We claim:

1. A method of bleaching and brightness stabilization of a lignocellulosic material comprising treating the lignocellulosic material with a water-soluble phosphine or phosphonium compound of formula (A):



$$z\,[X]^{m-} \qquad (A)$$

wherein t is zero or 1; when t = 0, $R_4R_5PY_2$ is absent and R_3 is bonded to the P of the $R_1R_2PY_1$ group; R_5 is absent, an alkylene group $(CH_2)_s$ (s = 1 to 12) interrupted by 0 to 6 oxygen (O) atoms or secondary amino (NR') groups, and/or substituted by a zero to 2s number of a hydroxyl, alkyl, aryl, thio, thioether, amino, ester, amide, carboxyl and/or carboxylate groups, or a phenylene group substituted by a zero to 4 number of a hydroxyl, alkyl, aryl, thio, thioether, amino, ester, amide, carboxyl, carboxylate, and/or sulfonate groups; or preferably R_5 is an alkylene group $(CH_2)s$ (s = 1 to 4) where the carbon chain is optionally interrupted by one or two oxygen (O) atom(s); Y_1 and Y_2 are both present or both absent, provided that when Y_1 and Y_2 are both absent, y = 1, n = z = m = 0 and X is absent;

wherein when Y_1 and Y_2 are both absent, y = 1, n = z = m = 0, and X is absent, R_1, R_2 and R_3, or R_1, R_2, R_3, R_4 and R_5 groups are collectively selected such that the molecule has an overall solubility of at least 0.01 g/L; R_1, R_2 and R_3, or R_1, R_2, R_3 and R_4 are independently selected from hydrogen, optionally substituted linear or branched alkyl groups, or optionally substituted aryl groups, the optional substitution

being the presence of substituents selected from ether, amino, hydroxy, ester, thioether, amide, carbonyl, carboxyl, and carboxylate moieties;

wherein when both Y_1 and Y_2 are present, X is an inorganic or organic anion, and the value of m is ≤ 5; the total charge of yn = zm; Y_1 is a hydroxymethyl group (CH_2OH); R_1, R_2 and R_3, or R_1, R_2, R_3, R_4 and Y_2 are independently selected from hydrogen, a Lewis acid such as boron trifluoride (BF_3), optionally substituted linear or branched alkyl groups, or optionally substituted aryl groups, the optional substitution being the presence of substituents selected from ether, amino, hydroxy, ester, thioether, amide, carbonyl, carboxyl, and carboxylate moieties.

2. A method according to claim 1 wherein Y_1 and Y_2 are both absent, R_1, R_2 and R_3, or R_1, R_2, R_3 and R_4 are independently hydrogen, an alkyl group (R) or an ether group (OR) with R being $(CH_2)_qH$ (q = 1 to 12) interrupted by 0 to 6 oxygen (O) atoms or secondary amino (NR') groups, and/or substituted by a zero to (2q + 1) number of a hydroxyl, thio, thioether, amino, ester, amide, carboxyl and/or carboxylate groups. R' is either hydrogen or an optionally substituted linear or branched alkyl group or optionally substituted aryl group; whereun optional substitution refers to the presence of one or more substituents selected from ether, amino, hydroxy, ester, thioether, amide, carbonyl, carboxyl, and carboxylate moieties.

3. A method according to claim 1, wherein Y_1 and Y_2 are both absent, R_1, R_2 and R_3, or R_1, R_2, R_3 and R_4 are independently hydrogen, an alkyl group (R) or an ether group (OR) with R being $CH_2(CH_2)_qH$ (q = 0 to 5) interrupted by 0 to 3 oxygen (O) atoms or secondary amino (NR') groups, and/or substituted by a zero to (2q + 1) number of a hydroxyl, thio, thioether, amino, ester, amide, carboxyl and/or carboxylate groups.

4. A method according to claim 1, wherein Y_1 and Y_2 are both absent, at least one of R_1 and R_2 is the same as R_3 in the molecule with R_3 being a hydroxymethyl (CH_2OH) group.

5. A method according to claim 1, wherein Y_1 and Y_2 are both absent, R_1, R_2 and R_3, or R_1, R_2, R_3 and R_4 are all hydroxymethyl (CH_2OH) groups.

6. A method according to claim 1, wherein Y_1 and Y_2 are present, Y_1 is a hydroxymethyl group (CH_2OH), R_1, R_2 and R_3, or R_1, R_2, R_3, R_4 and Y_2 are independently hydrogen, a Lewis acid such as boron trifluoride (BF_3), an alkyl group (R) or an ether group (OR) with R being $(CH_2)_qH$ (q = 1 to 12) interrupted by 0 to 6 oxygen (O) atoms or secondary amino (NR') groups, and/or substituted by a zero to (2q + 1) number of a hydroxyl, thio, thioether, amino, ester, amide, carboxyl and/or carboxylate groups. R' is either hydrogen or an optionally substituted linear or branched alkyl group or optionally substituted aryl group; wherein optional substitution refers to the presence of substituents selected from ether, amino, hydroxy, ester, thioether, amide, carbonyl, carboxyl, and carboxylate moieties.

7. A method according to claim 1, wherein Y_1 and Y_2 are present, Y_1 is a hydroxymethyl group (CH_2OH), R_1, R_2 and R_3, or R_1, R_2, R_3, R_4 and Y_2 are independently hydrogen, a Lewis acid such as boron trifluoride (BF_3), an alkyl group (R) or an ether group (OR) with R being $CH_2(CH_2)_qH$ (q = 0 to 5) interrupted by 0 to 3 oxygen (O) atoms or secondary amino (NR') groups, and/or substituted by a zero to (2q + 1) number of a hydroxyl, thio, thioether, amino, ester, amide, carboxyl and/or carboxylate groups.

8. A method according to claim 1, wherein X is selected from chloride, sulfate, hydroxide, hydrosulfite, phosphate, carbonate, bicarbonate, bisulfate, alkoxide, formate, acetate, citrate, oxalate, ascorbate, ethylenediaminetetraacetate or diethylenetriaminepentaacetate.

9. A method according to claim 1, wherein Y_1 and Y_2 are present, Y_1 is a hydroxymethyl group (CH_2OH), and at least one of R_3, R_4 and Y_2 is a hydroxymethyl (CH_2OH) group.

10. A method according to claim 1 wherein said compound is the phosphine tris(hydroxymethyl)phosphine (THP), $P(CH_2OH)_3$.

11. A method according to claim 1 wherein said compound is the phosphine tris(hydroxypropyl)phosphine (THPP), $P(CH_2CH_2CH_2OH)_3$.

12. A method according to claim 1 wherein said compound is the phosphine bis[bis(hydroxymethyl)phosphino]ethane, $(HOCH_2)_2PCH_2CH_2P(CH_2OH)_2$.

13. A method according to claim 1 wherein said compound is the phosphonium compound tetrakis(hydroxymethyl)phosphonium chloride (THPC), $[P(CH_2OH)_4]Cl$.

14. A method according to claim 1 wherein said compound is the phosphonium compound tetrakis(hydroxymethyl)phosphonium sulfate (THPS), $[P(CH_2OH)_4]_2SO_4$.

15. A method according to claim 1 wherein said compound is the phosphonium compound 3-[tris(hydroxymethyl)phosphonium]propionate, $(CH_2OH)_3P^+$-$CH_2CH_2COO^-$.

16. A method according to claim 1 wherein said lignocellulosic material is a mechanical wood pulp.

17. A method according to claim 16 wherein said lignocellulosic mechanical wood pulp is spuce TMP or aspen CTMP.

18. A method according to claim 1 wherein the said lignocellulosic material is a mechanical wood pulp that has been partially or fully bleached with other bleaching

chemicals such as alkaline hydrogen peroxide and/or sodium dithionite.

19. A method according to claim 1 wherein the said lignocellulosic material is a chemical wood pulp such as unbleached kraft pulp or kraft pulp partially or fully delignified and/or bleached with other delignifying and/or bleaching chemicals such as oxygen and/or chlorine dioxide.

20. A method according to claim 1 wherein the said lignocellulosic material is a paper sheet containing mechanical wood pulp as the sole pulp component or as one of the pulp components.

21. A method according to claim 1 wherein the treatment is conducted in an aqueous medium at a pH of 2.0 – 12.0, a temperature of 20 – 170 °C and a consistency of 0.01 – 99% for 5 minutes to 30 days with a charge of the phosphorus compound being 0.01 to 6.0%, by weight, based on the oven-dry (OD) weight of the lignocellulosic material.

22. A method according to claim 1 wherein the treatment is conducted at a temperature of 20 – 170 °C and a consistency of 40 – 99% for 5 minutes to 30 days with a charge of the phosphorus compound being 0.01 to 6.0%, by weight, based on the oven-dry (OD) weight of the lignocellulosic materials.

23. A method according to claim 1 wherein the treatment is carried out in a single-stage or multi-stage in one or more than one bleach tower, pulp mixer, a storage vessel, an agitated tank or any other stock preparation vessels of a paper machine, or any other vessels suitable for performing the treatment of the pulp.

24. A method according to claim 1, wherein the material is also treated with: (a) an organic or inorganic yellowing inhibitor such as a benzotriazole, benzophenone or titanium dioxide ultraviolet absorber (UVA), or a hindered hydroxyamine radical

scavenger (RS), (b) a polymeric yellowing inhibitor such as poly(ethylene glycol) or poly(vinyl pyrrolidone), and/or (c) a metal chelating agent such as diethylenetriaminopentaacetic acid (DTPA).

25. A method according to claim 1, wherein said treating comprises contacting said material with said water-soluble compound in an aqueous vehicle.

26. A pulp produced by a method as defined in claim 1.

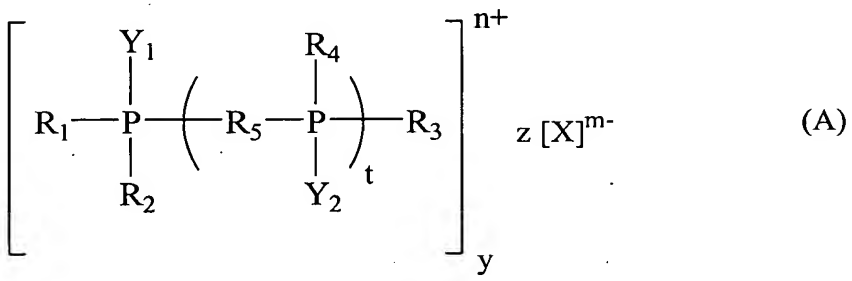
27. A pulp according to claim 26 wherein said lignocellulosic material is a blended wood pulp.

28. A paper sheet containing a pulp of claim 27.

29. A paper sheet according to claim 28 containing said pulp as the sole pulp component.

30. A paper sheet according to claim 28 containing said pulp as one of the pulp components.

31. A lignocellulosic material bleached and brightness stabilized with a water-soluble phosphine or phosphonium compound of formula (A):



(A)

wherein t is zero or 1; when t = 0, $R_4R_5PY_2$ is absent and R_3 is bonded to the P of the $R_1R_2PY_1$ group; R_5 is absent, an alkylene group $(CH_2)_s$ (s = 1 to 12) interrupted by 0

to 6 oxygen (O) atoms or secondary amino (NR') groups, and/or substituted by a zero to 2s number of a hydroxyl, alkyl, aryl, thio, thioether, amino, ester, amide, carboxyl and/or carboxylate groups, or a phenylene group substituted by a zero to 4 number of a hydroxyl, alkyl, aryl, thio, thioether, amino, ester, amide, carboxyl, carboxylate, and/or sulfonate groups; or preferably R_5 is an alkylene group $(CH_2)s$ (s = 1 to 4) where the carbon chain is optionally interrupted by one or two oxygen (O) atom(s); Y_1 and Y_2 are both present or both absent, provided that when Y_1 and Y_2 are both absent, y = 1, n = z = m = 0 and X is absent;

wherein when Y_1 and Y_2 are both absent, y = 1, n = z = m = 0, and X is absent, R_1, R_2 and R_3, or R_1, R_2, R_3, R_4 and R_5 groups are collectively selected such that the molecule has an overall solubility of at least 0.01 g/L; R_1, R_2 and R_3, or R_1, R_2, R_3 and R_4 are independently selected from hydrogen, optionally substituted linear or branched alkyl groups, or optionally substituted aryl groups, the optional substitution being the presence of substituents selected from ether, amino, hydroxy, ester, thioether, amide, carbonyl, carboxyl, and carboxylate moieties;

wherein when both Y_1 and Y_2 are present, X is an inorganic or organic anion, and the value of m is ≤ 5; the total charge of yn = zm; Y_1 is a hydroxymethyl group (CH_2OH); R_1, R_2 and R_3, or R_1, R_2, R_3, R_4 and Y_2 are independently selected from hydrogen, a Lewis acid such as boron trifluoride (BF_3), optionally substituted linear or branched alkyl groups, or optionally substituted aryl groups, the optional substitution being the presence of substituents selected from ether, amino, hydroxy, ester, thioether, amide, carbonyl, carboxyl, and carboxylate moieties.

32. A lignocellulosic material according to claim 31, wherein said material is a pulp or paper containing said compound of formula (A) in an amount of 0.01 to 6.0%, by weight, based on the dry weight of said material.